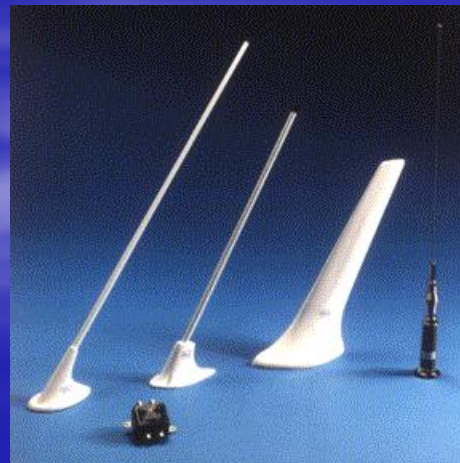
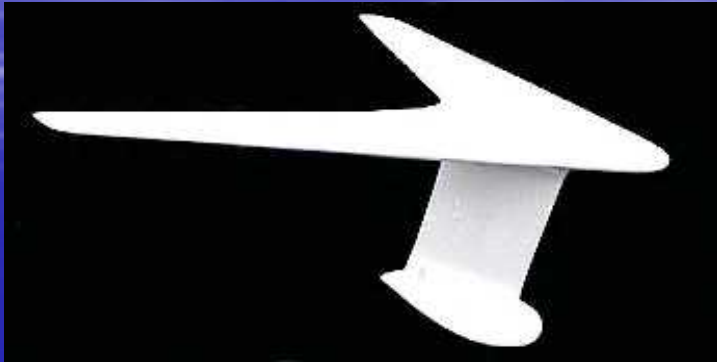


AEROSPACE AVIONICS

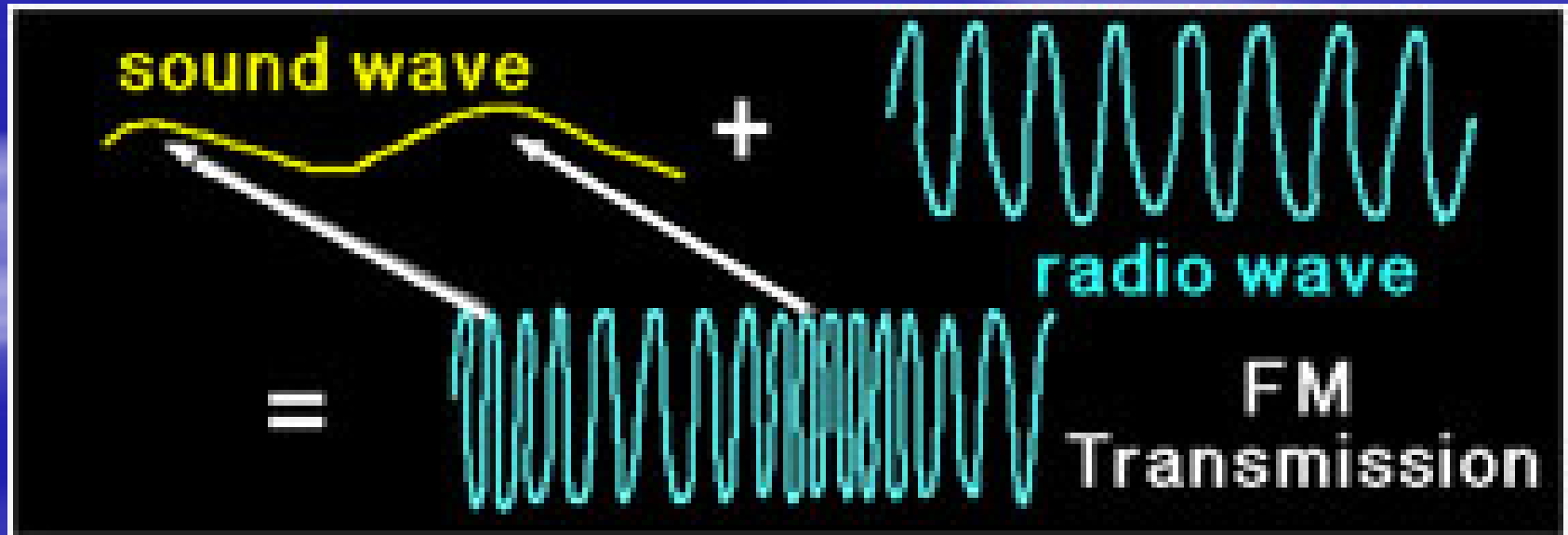


Aircraft antennas



Frequency modulation (FM)

- In frequency modulation, the frequency or phase of the carrier wave is changed. There is no change in power of the signal.



Antennas

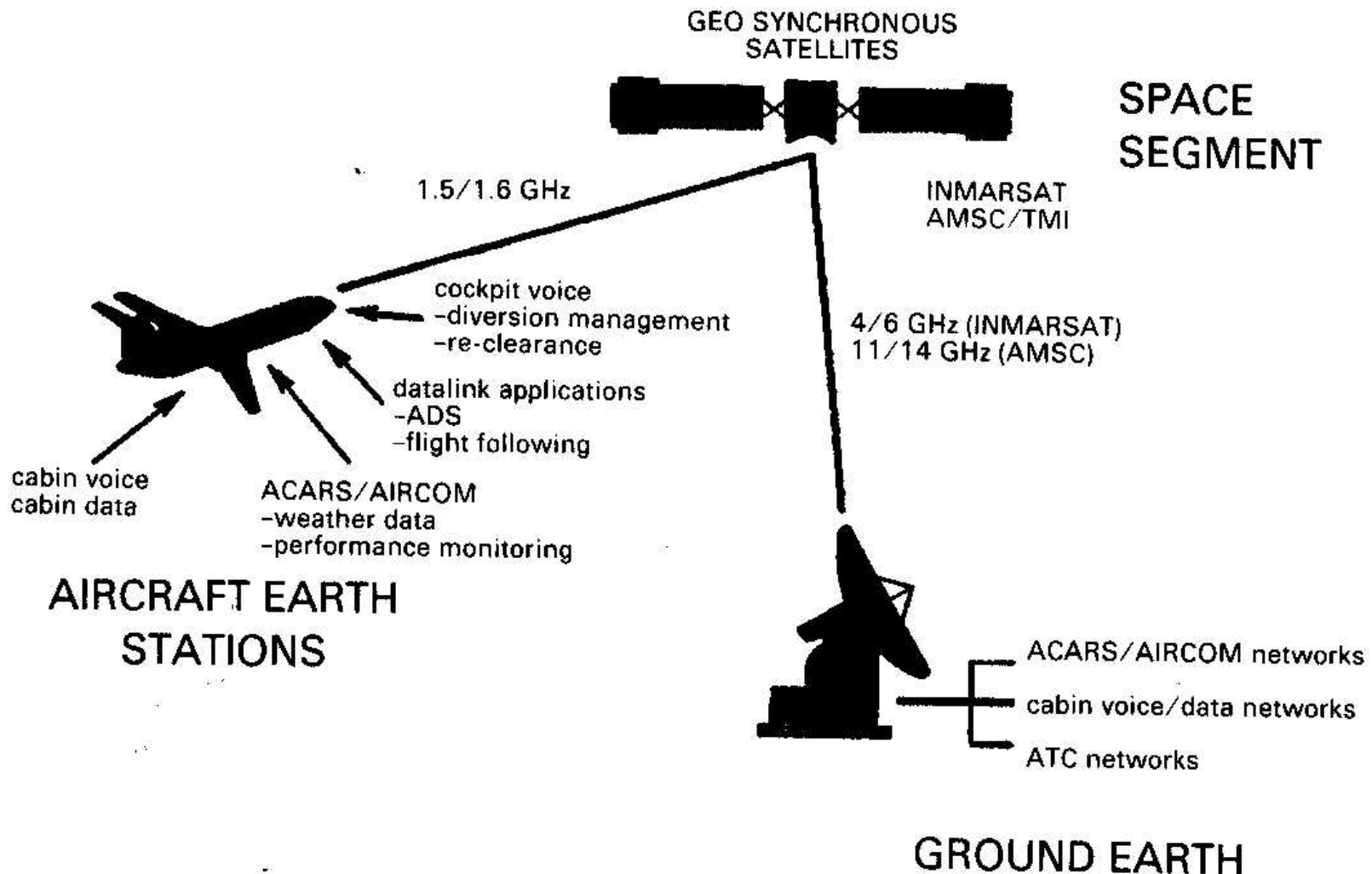


VHF COM



HF COM

SATCOM



VHF OMNIRANGE (VOR) NAVIGATION SYSTEM



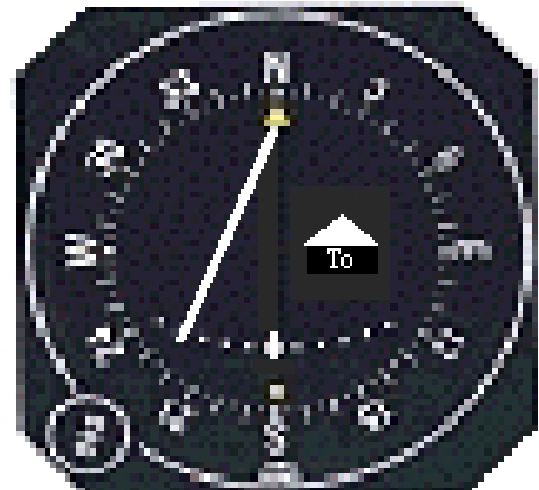
VOR Operation

- VOR ground stations transmits signals (**radials**) through 360° (omni directional).
- This extensive system of ground facilities consists of several hundreds ground stations

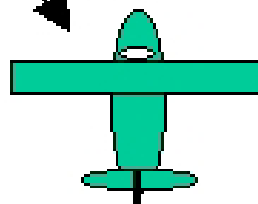
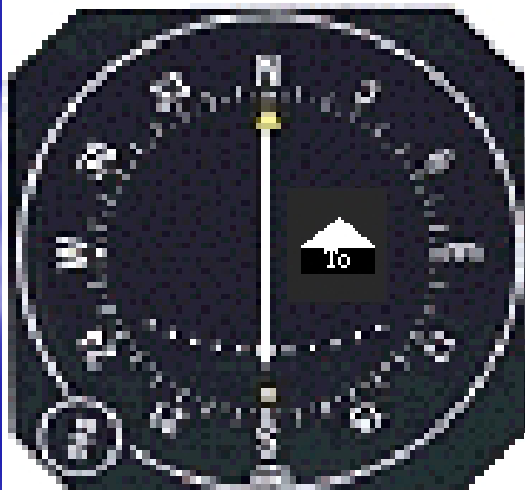


VOR indications

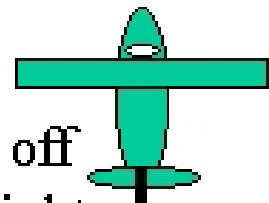
Desired
Course
0 degrees
North



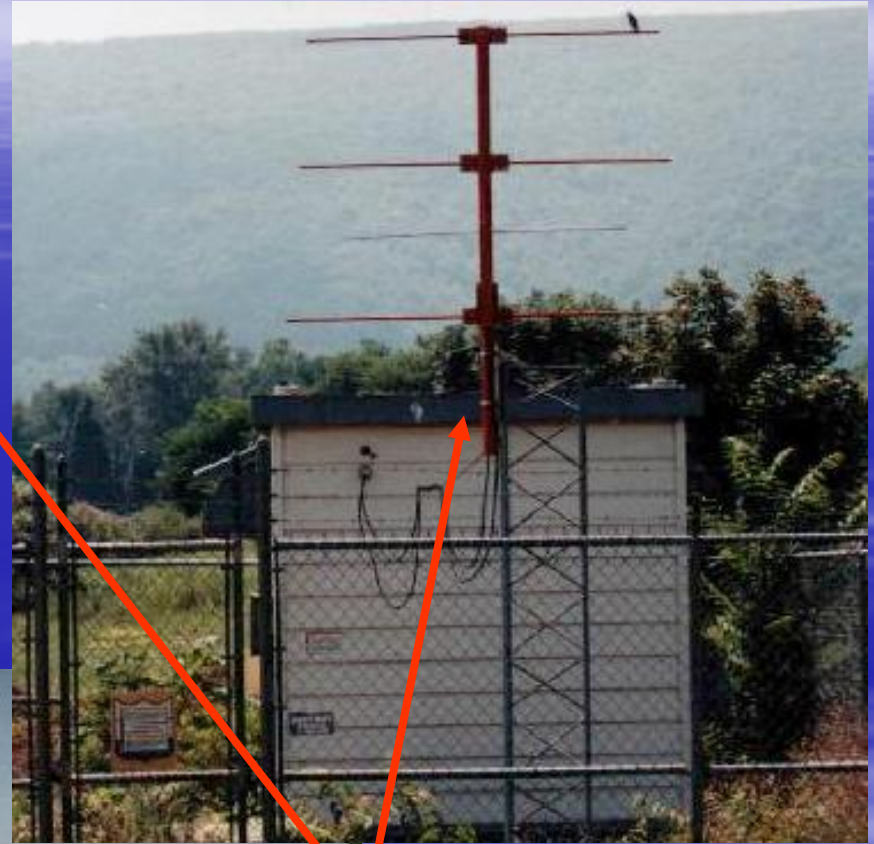
This aircraft is on course,
so the needle is centered.



This aircraft is off
course to the right,
so the needle swings toward
the proper course.



The Marker Ground Station



Approach lights

Antenna

Marker beacons

Inner Marker
White Light
3000 HZ Modulation
Located at the numbers
Only at CAT III Airports.



Flight Path (Glidepath)

Outer Marker
Blue Light
400 HZ Modulation
Located approximately
5 miles from the end of
the runway.



Runway



Middle Marker

Amber Light

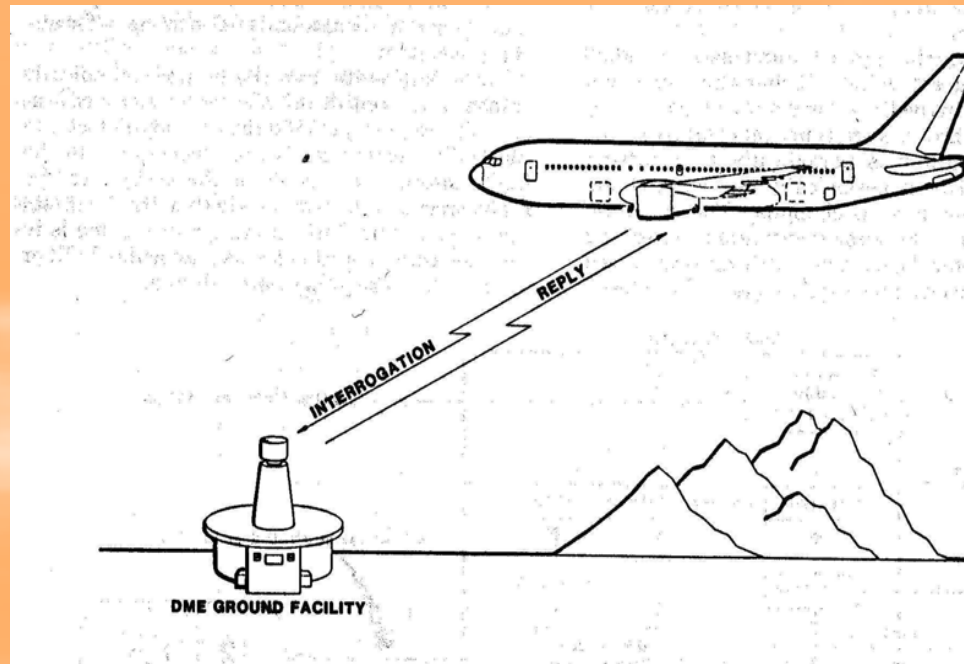
1300 HZ Modulation

Located approximately

.5 miles from end of the runway.

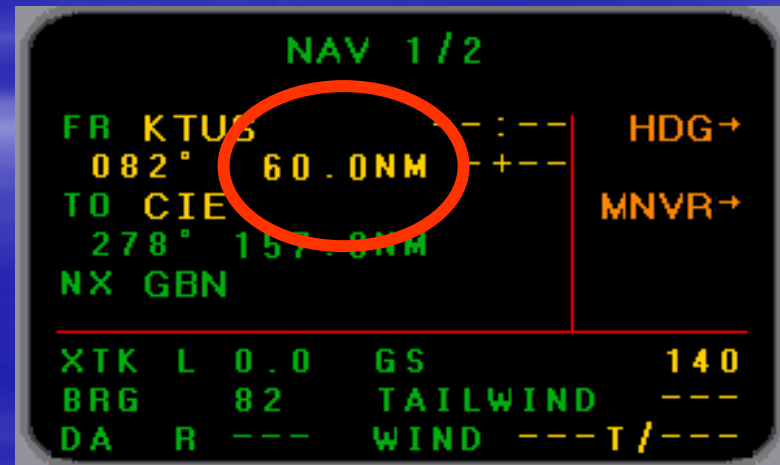


DISTANCE MEASURING EQUIPMENT (DME)

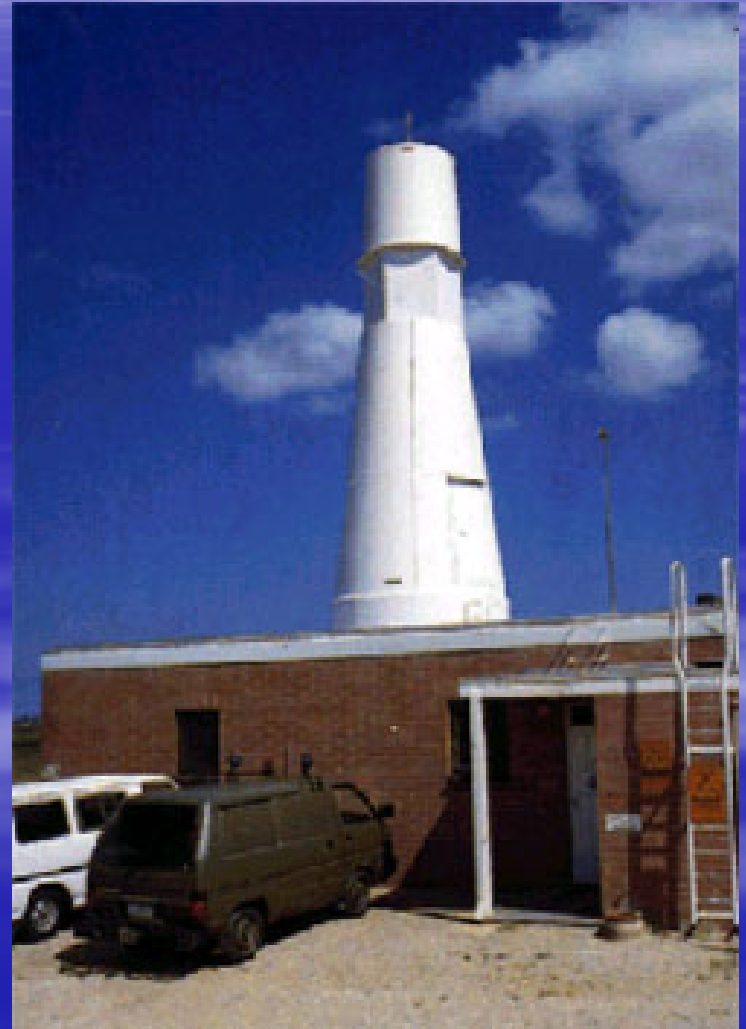
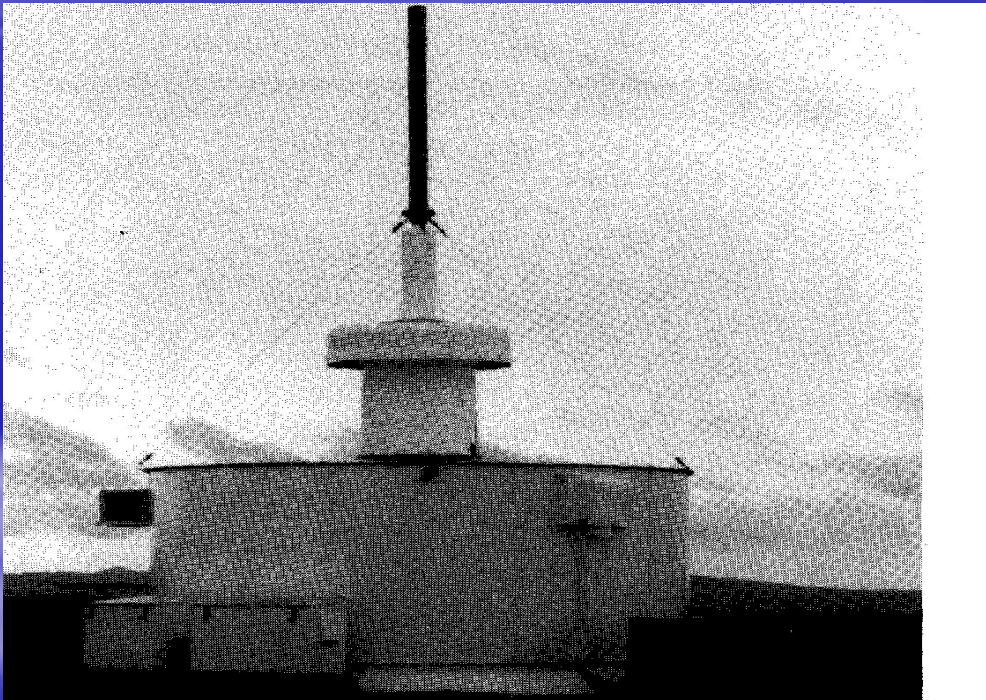


Indicator

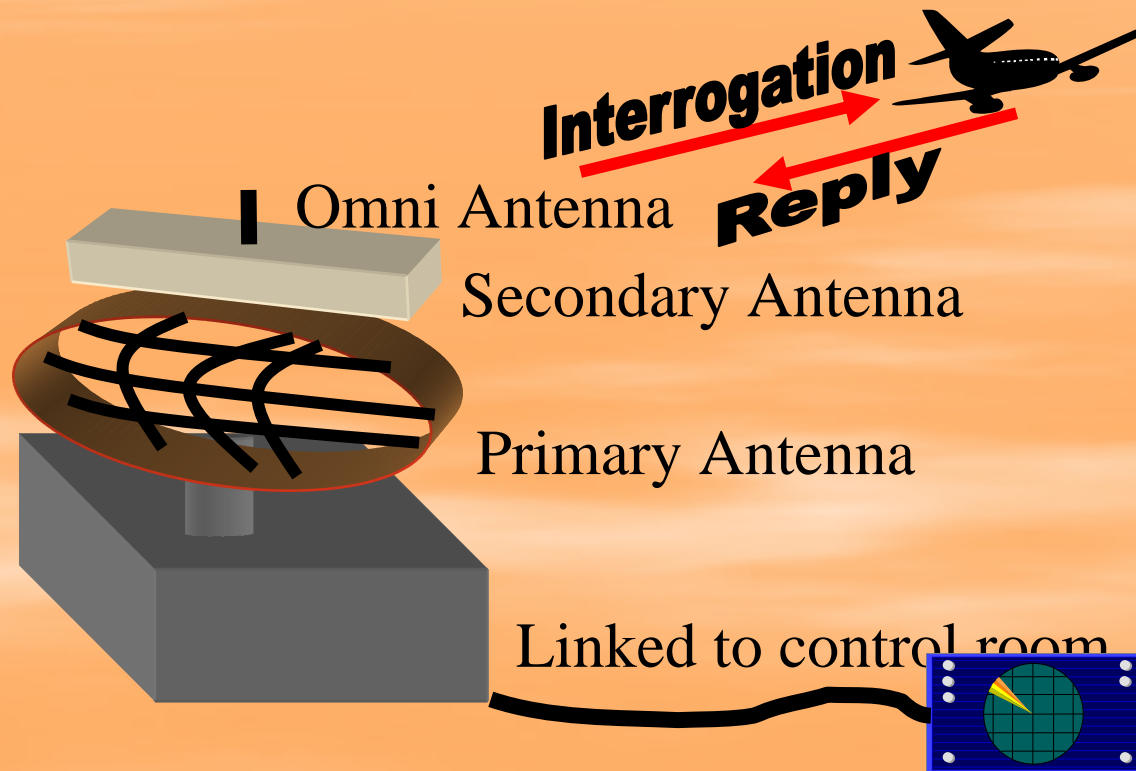
- Styles
 - self contained
 - integrated
- Warning flag
- Self Test
- Digital



VOR/DME Ground station



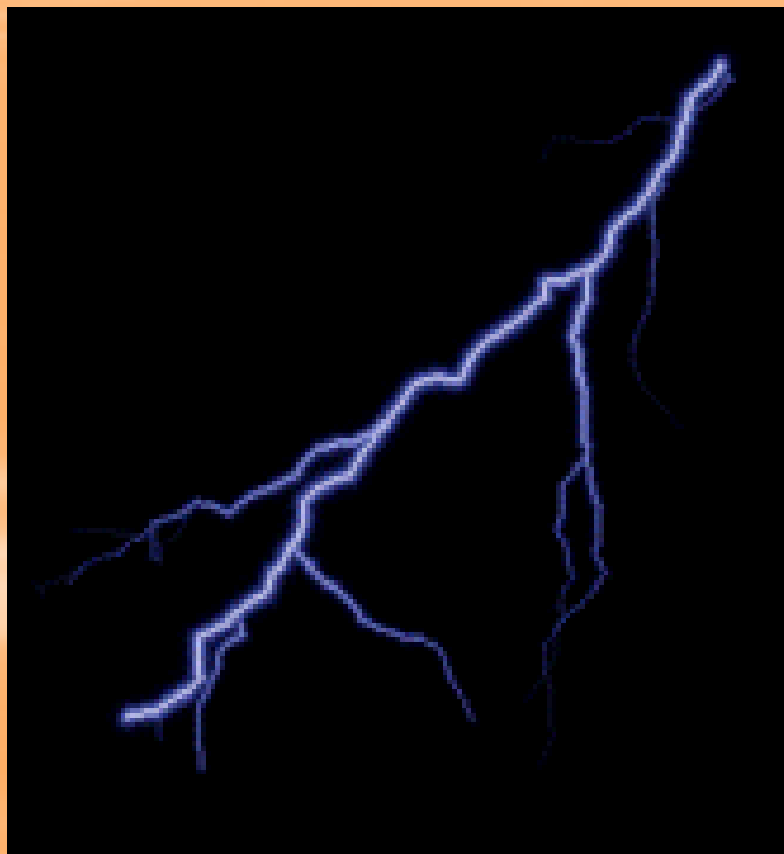
AIR TRAFFIC CONTROL (ATC) TRANSPONDER



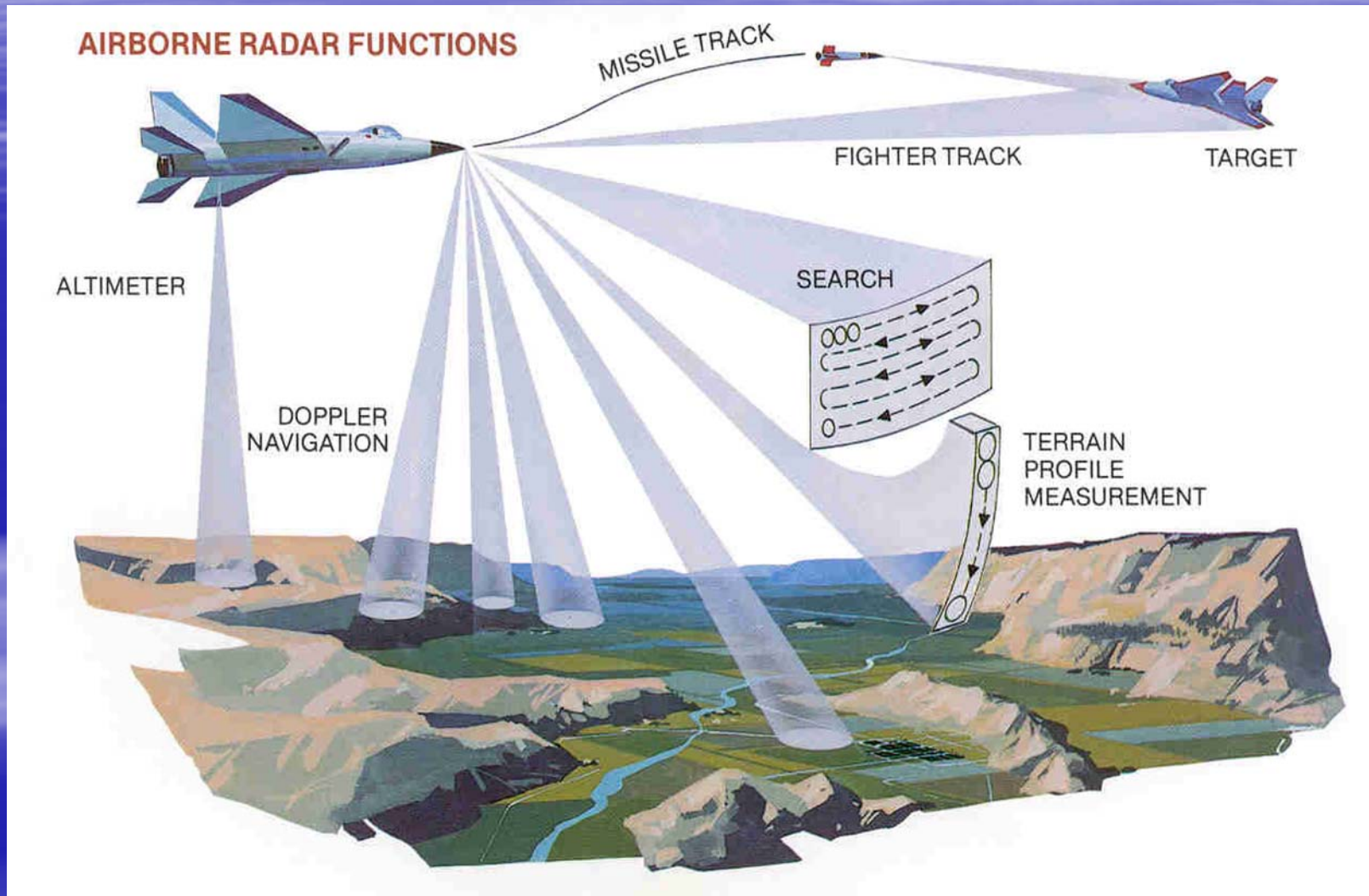
Ground station



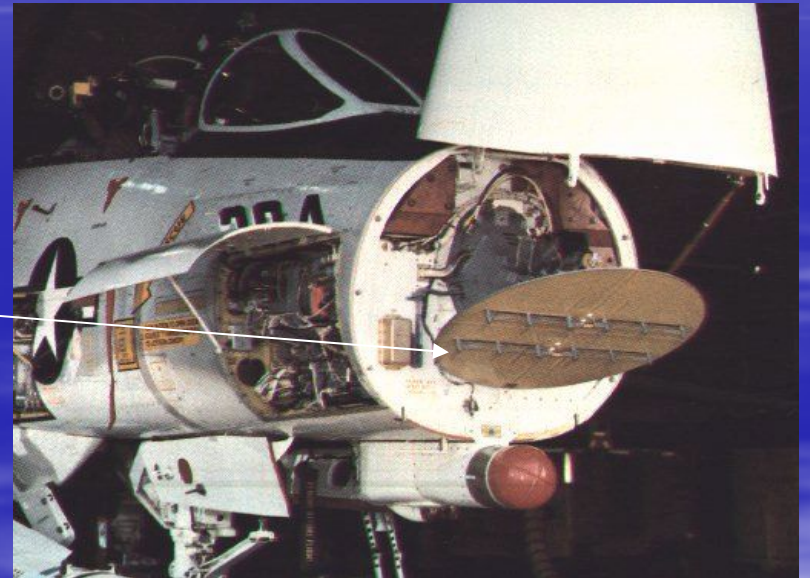
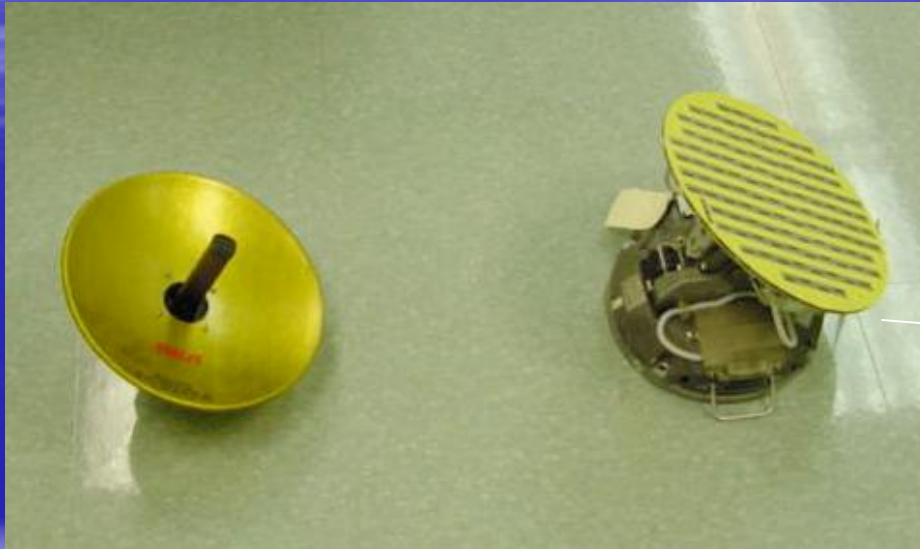
WEATHER RADAR



Airborne radar functions (military)



Radar Antennas



Weather Radar

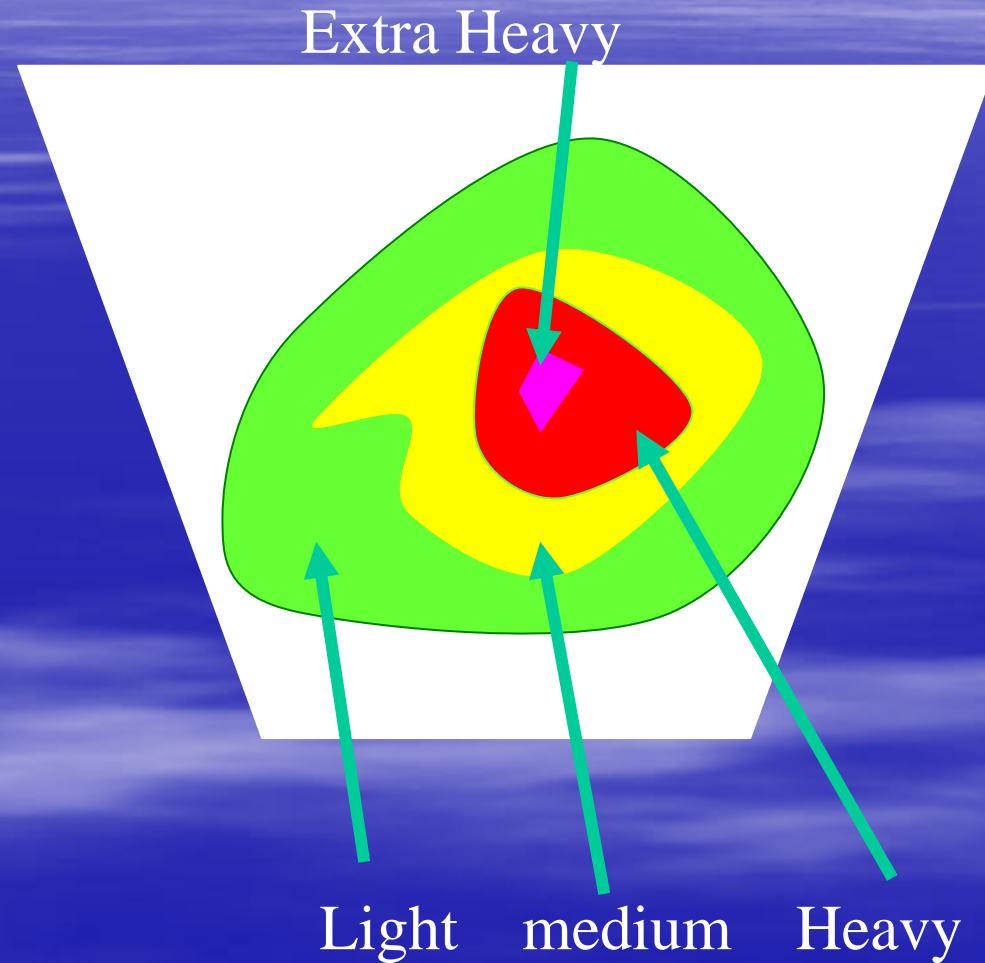
- It provides pilot with the local picture of the weather ahead and allow him to avoid undesirable weather formations.
- A maximum range is about 180 NM, but usually operated at 30-80 NM.



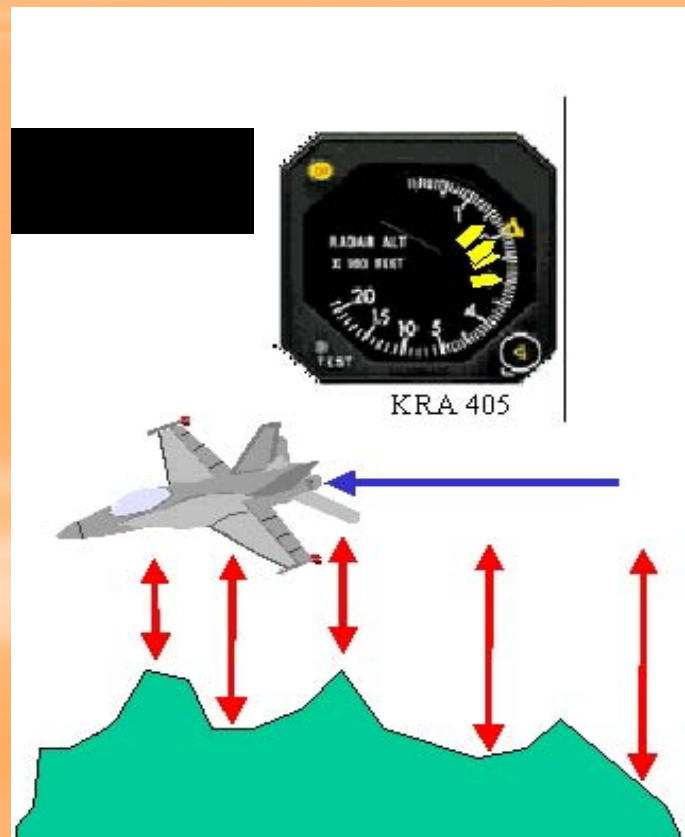
Weather radar display



Weather Radar Display

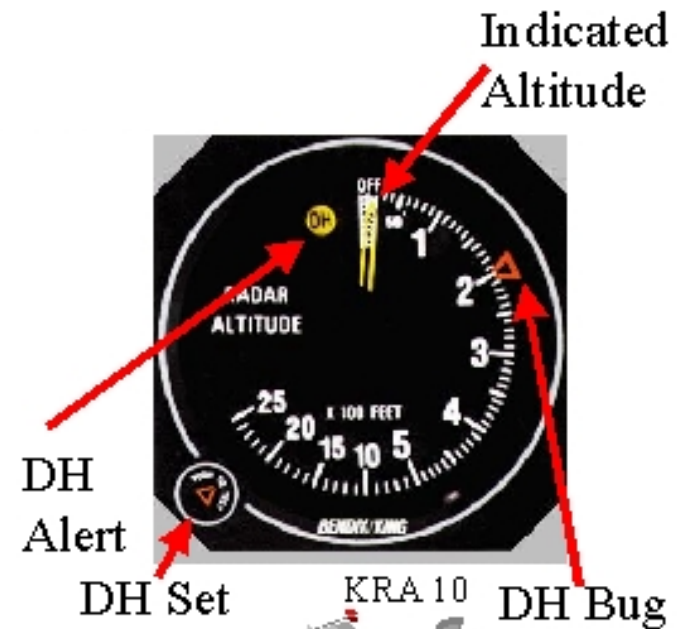


RADIO ALTIMETER

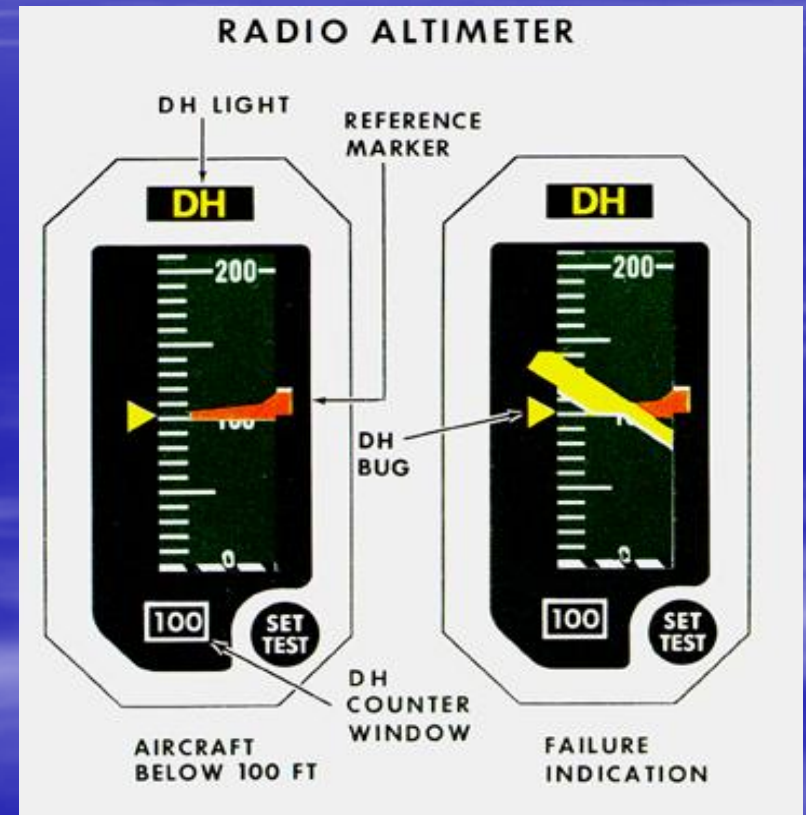
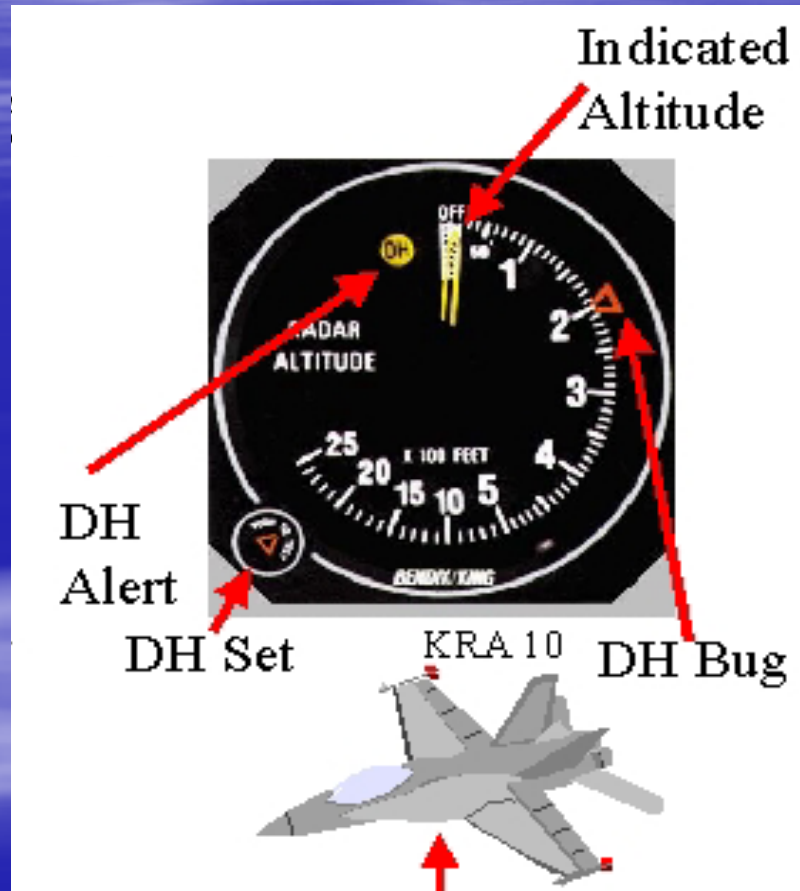


Radio altimeter's function

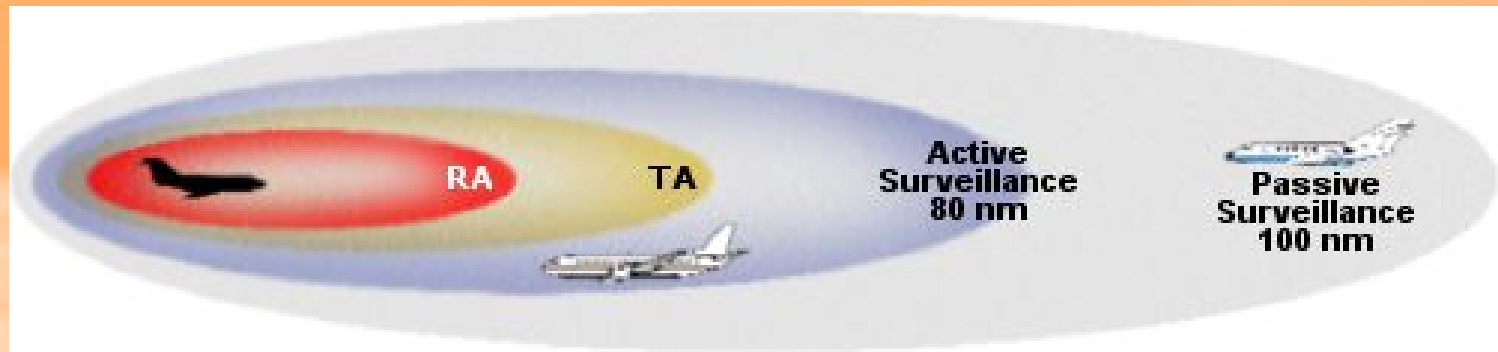
- Used on approach to indicate absolute altitude above ground, and to remind the pilots when decision height (DH) is reached.



Radio altimeter indicators



TRAFFIC COLLISION & AVOIDANCE SYSTEM (TCAS)



Function of TCAS

- Main function of TCAS is to help aircrews avoid midair collisions.
- In addition to this, TCAS also provides a backup to the air traffic control system's regular separation processes.



TCAS display integrated in navigation page



TCAS control head

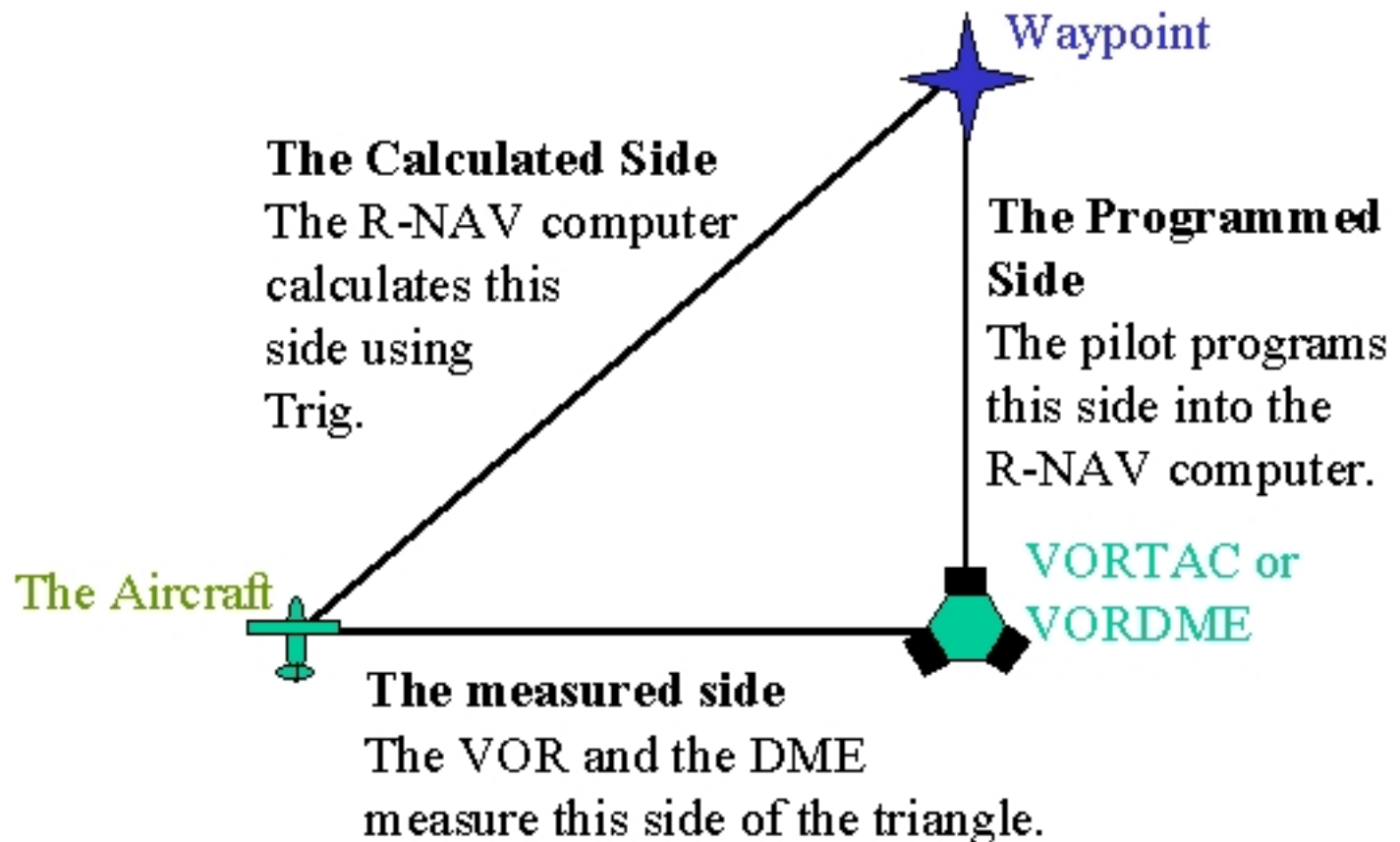


AREA NAVIGATION (RNAV) SYSTEMS

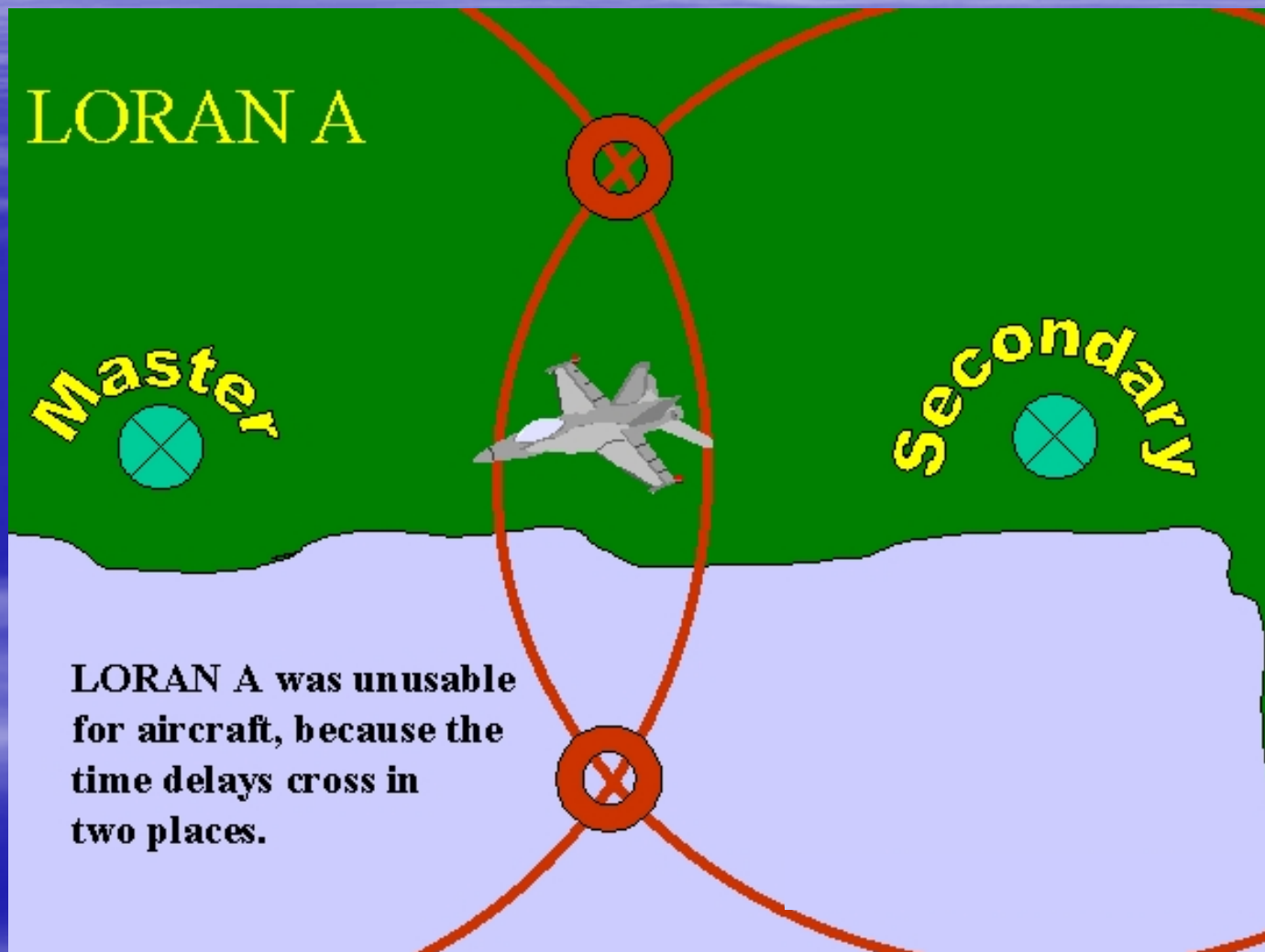


VOR/DME RNAV principle

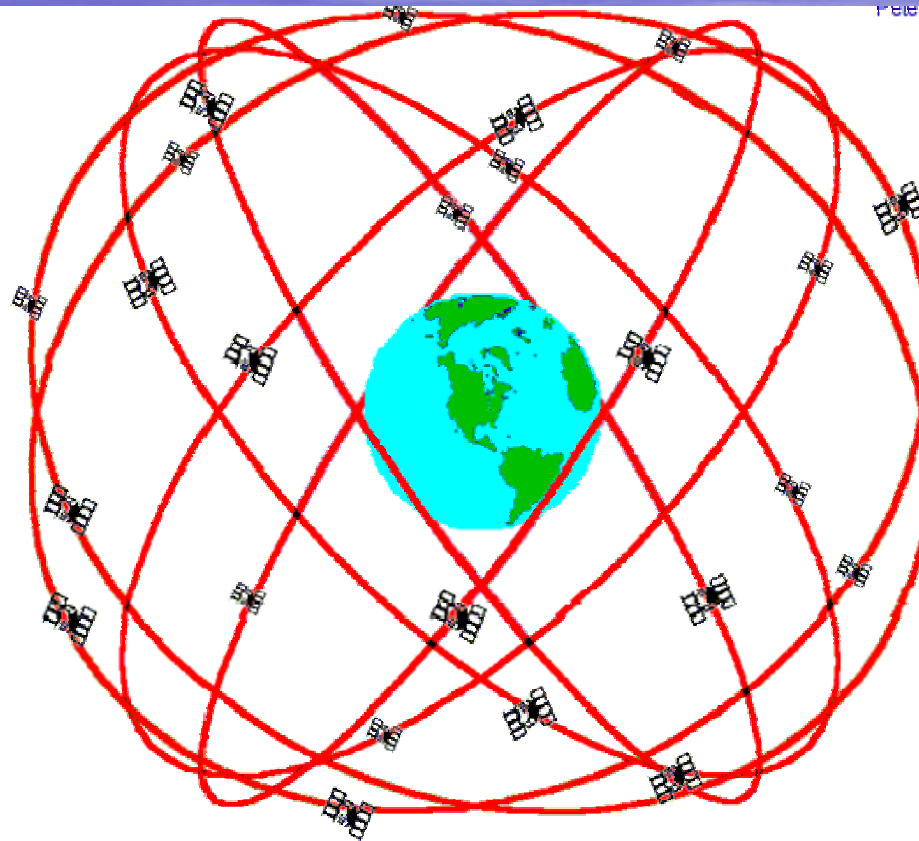
The R-NAV Triangle



LORAN-A



SPACE SEGMENT



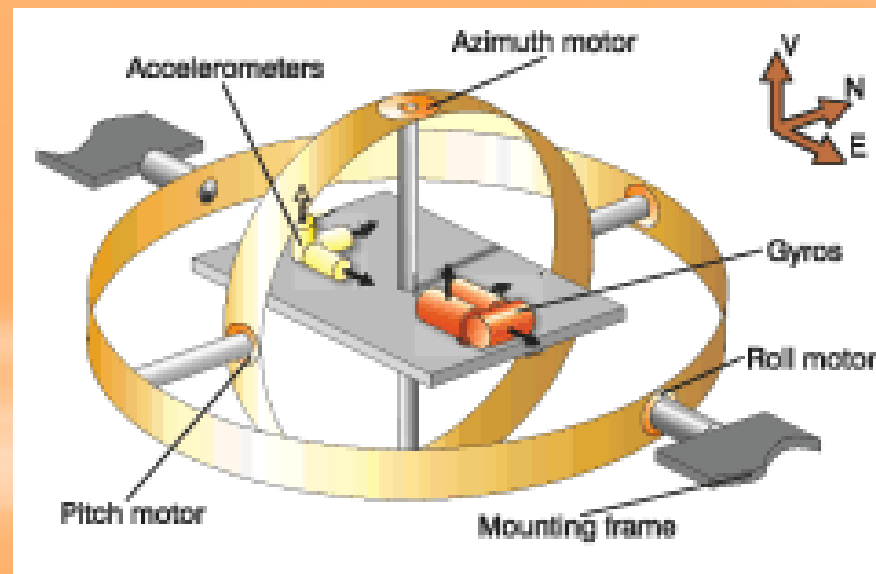
GPS Nominal Constellation
24 Satellites in 6 Orbital Planes
4 Satellites in each Plane
20,200 km Altitudes, 55 Degree Inclination

Control Segment



Global Positioning System (GPS) Master Control and Monitor Station Network

INERTIAL NAVIGATION SYSTEM (INS)



Fighter Cockpit



Modern Airliner Cockpit

